Remarks:

1. Claims 1 through 29 were originally presented in the instant application. Claims 1 through 29 were cancelled without prejudice and claims 30 through 76 added in a preliminary amendment accompanying a Request for Continuing Examination filed on December 15, 2005. No claims have been added or canceled in this paper. Claims 30, 38, 39, 45, 55, and 62-67 have been amended as described in more detail below. Claims 30 through 76 remain pending.

35 U.S.C. §112, First Paragraph Rejections

2. Claims 62, 63, 65, and 66-76 stand rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. Applicant respectfully traverses these rejections. Applicant will first address the rejection of claim 65, followed by the rejections of claims 62 and 63, and then the rejections of claims 66-76.

3. Previously presented claim 65 depends from independent claim 55 and further recites: "no dielectric assumption is made in the first transformation." It is clear throughout the specification that the recited element is stating that the first transformation does not assume that the dielectric constant is a mathematical function of the conductivity. In other words, previously presented claim 65 teaches a first transformation in which the dielectric constant is independent of the conductivity. Notwithstanding, claim 65 has been amended to more clearly recite the inventive subject matter. Claim 65, as amended, now recites: "wherein a conductivity and a dielectric constant are independent of one another in the first transformation." Applicant respectfully submits that claim 65, as amended, is supported, for example, by Paragraphs [0133], [0134], and [0135] of the original specification. Paragraphs [0133] and [0134] teach that the dielectric constant ε is independent (i.e., not a mathematical function) of the conductivity σ in the equation: $w_1 = \overline{F}(\overline{\sigma}*, \overline{\varepsilon}*, \overline{b}*)$. Paragraph [0135] teaches a first transformation $\overline{F}_0^{-1}(\cdot)$ including no dielectric assumption, i.e., in which the conductivity and dielectric constant are independent of one another. Applicant therefore

submits that claim 65, as amended, is supported by the original specification and requests the Examiner to withdraw his §112 rejection.

4. Claims 62 and 63 have been amended to more clearly recite the inventive subject matter. In particular, claims 62 and 63 now recite "real" and "imaginary" parts (respectively) of the estimated electrical signals. Applicant respectfully submits that claims 62 and 63 are supported, for example, by Paragraphs [0041] and [0051] of the original specification, as well as by original FIGURES 5A-5D. In particular, Paragraph [0041] states: "the shape of Figure 5a is very dissimilar to the shape of Figure 5c. This means that the underlying measurements [attenuation and phase shift] are sensitive to the variables ***in different volumes***". Paragraph [0041] goes on to state: "it is possible to transform an attenuation and phase shift measurement to a complex number which has the following desirable properties: 1) its ***real part*** is sensitive to the resistivity in the same volume that the ***imaginary part*** is sensitive to the dielectric constant". Applicant therefore submits that claims 62 and 63, as amended, are supported by the original specification and requests the Examiner to withdraw his §112 rejections.

5. The Examiner is not clear which elements of claims 66-76 he believes fail to meet the written description requirement. Therefore, Applicant will address independent claim 66 (claims 67-76 all depend from claim 66). In particular, Applicant will address elements (c) and (d) of claim 66 in which the first and second transformations are said to include a "permuted dielectric assumption". As stated in the December 15, 2005 response, Applicant believes claim 66 to be supported by Paragraphs [0151]-[0155] of the original specification. Beginning in Paragraph [0151], an equation is presented in which the dielectric constant ε is assumed to be a function $\varepsilon(\sigma)$ of the conductivity σ. In Paragraphs [0153] and [0154], transformations A_0 and $\overline{P}_0$ may be applied to the measured electrical signals $\overline{w}_1$ and the model estimates $\overline{F}(\cdot)$. As stated in Paragraph [0153], the transformations $\overline{A}_0$ and $\overline{P}_0$ convert the measured voltage ratios to corresponding attenuation (A) and phase (P) resistivities. Paragraph [0153] also states that calculation of the phase and attenuation

resistivity values is discussed in two previous sections of the specification. These sections can be found, respectively, beginning at Paragraphs [0097] and [0103]. In Paragraph [0100] (which is in the first section), first and second coupled equation are shown that utilize a fully ***permuted dielectric assumption***. As stated in Paragraph [0101]: "the attenuation conductivity is evaluated using a dielectric value consistent with the phase conductivity and the phase conductivity is evaluated using a dielectric constant consistent with the attenuation conductivity." In Paragraph [0103], first and second equations are presented that include a partially ***permuted dielectric assumption***. As shown, the first equation includes a permuted dielectric assumption and the second equation does not. As stated in Paragraph [0105]: "the second equation evaluates phase conductivity σ_P and the dielectric constant correlation with the same phase conductivity... The first equation evaluates the attenuation conductivity σ_A and the dielectric constant correlation with the phase conductivity (not an attenuation conductivity)..." Applicant therefore submits that the original specification supports elements (c) and (d) of claim 66 in which first and second transformations include a permuted dielectric assumption. These transformations are represented, for example, by $\overline{A}_0$ in Paragraph [0154] as shown on the left and right hand side of the equation. Applicant therefore submits that claim 66, as amended to correct an inadvertent omission, is supported by the original specification and requests the Examiner to withdraw his §112 rejection.

6. Applicant further submits that previously presented claim 71, which depends from claim 66, is also supported by the original specification. The third and fourth transformations are represented, for example, by $\overline{P}_0$ in Paragraph [0153] as shown on the left and right hand side of the equation. As described in the preceding paragraph of this paper (and in Paragraphs [0100] and [0103] of the original specification), the third and fourth transformations may or may not include a permuted dielectric assumption. Claim 71 recites an embodiment in which a non-permuted dielectric assumption is utilized (as described Paragraph [0103] of the original specification). Applicant therefore submits that claim 71 is supported by the original specification. Applicant further submits that dependent claims 67-

70 and 72-76 are also supported by the original specification and requests the Examiner to withdraw his §112 rejections of dependent claims 67-76.

35 U.S.C. §112, Second Paragraph Rejections

7. Claims 30-76 are apparently rejected under 35 U.S.C. §112, second paragraph, as being indefinite. In particular, the Examiner states: "the terms 'substantially equal', 'substantially insensitive', 'relatively sensitive', and 'relatively insensitive' in claims 30-76 are relative terms which render the claims indefinite. The Examiner further states: "the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention."

8. Applicant notes that MPEP §2173.05(b) allows for some usage of relative terminology. Applicant has searched claims 30-76 for the "indefinite" language referred to by the Examiner. Claims 30, 38, 39, 45, and 55 use one or more of the terms 'substantially insensitive', 'relatively sensitive', and 'relatively insensitive'. Applicant asserts that one of ordinary skill in the art would readily understand what is claimed in said claims based on the original specification and figures. For example, FIGURES 5a-5d and 6a-6d (along with Paragraphs [0040] – [0047] of the original specification) go to great lengths to define the meanings of the terms sensitive and insensitive as they pertain to formation conductivity and dielectric constant. Notwithstanding, in order to move prosecution forward, Applicant has accommodated the Examiner and amended claims 30, 38, 39, 45, and 55 to remove the terms 'substantially' and 'relatively' as modifiers for the terms 'sensitive' and 'insensitive'. Applicant therefore submits that claims 30, 38, 49, 45, and 55 are definite and requests the Examiner to withdraw his §112 rejections of said claims.

9. Claims 64 and 67 recite a first transformation that is 'substantially identical' to a second transformation. Again, in order to move prosecution forward, Applicant has accommodated the Examiner and amended claims 64 and 67 to remove the term 'substantially' as a modifier for the term 'identical'. Applicant therefore submits that claims

64 and 67 are definite and requests the Examiner to withdraw his §112 rejections of said claims.

10. Claims 30, 45, 55, 66, and 72 use the term 'substantially equal'. In claims 30 and 45 values are assigned in (c) when estimated electrical signals (from a model) are 'substantially equal' to measured electrical signals. In claims 55 and 66, values are assigned in (e) when a first result is 'substantially equal' to a second result. Applicant asserts that the term 'substantially equal' as used in claims 30, 45, 55, 66, and 72 is definite and that one of ordinary skill in the art would recognize when estimated signals and measured signals (or a first and second result) were substantially equal. Mathematical modeling (numerical modeling) techniques are commonly utilized to converge on a solution in which the modeler is required to set one result or variable 'equal' to another in order to determine some parameter. In the downhole arts the Marquardt-Levenberg and Newton-Gauss methods are well known (both being available in the public domain). Such methods typically minimize a difference between two quantities (e.g., the square of a difference in the Marquardt-Levenberg technique) to determine an 'equality'. The 'equality' is typically selected within predetermined bounded limits to arrive at the appropriate precision of the sought after parameter (e.g., conductivity and dielectric constant in the instant invention). Those of ordinary skill in the art routinely select (and are therefore readily able to select) bounded limits such that the assigned parameter value has the desired precision. Applicant therefore asserts that the term "substantially equal' as used in claims 30, 45, 55, 66, and 72 is definite and would be clearly understood by those of ordinary skill in the art.

11. Moreover, Applicant notes from MPEP §2173(b)(D.) that the term substantially, as in 'substantially equal', has been held by the courts to be definite. In particular, in quoting *Andrew Corp. v. Gabriel Electronics*, 847, F.2d 819, 6 USPQ2d 2010 (Fed. Cir. 1988), MPEP §2173(b) states: "one of ordinary skill in the art would know what was meant by 'substantially equal'". Applicant therefore respectfully submits that claims 30, 45, 55, 66, and 72 are definite and requests the Examiner to withdraw his §112 rejections of said claims.

35 U.S.C. §102 Rejections

12. Claims 30-76 stand rejected under 35 U.S.C. §102(b) as being anticipated by Clark et al (U.S. Patent 4,968,940). In particular, the Examiner states that columns 6 and 12 of *Clark et al* anticipate the subject matter of independent claims 30, 45, 55, and 66. Applicant respectfully traverses these rejections.

13. As stated above claims 30-76 stand rejected as being anticipated by *Clark et al*. The *Clark et al* patent is discussed at length in the Background section of the instant invention as being representative of the prior art methods and assumptions. For example, as described in Paragraph [0011] of the original specification:

> "a commonly used current practice [prior art practice] relies on ***assuming a correlative relationship between the resistivity and the dielectric constant*** (i.e., to transform the dielectric constant into a variable that depends on the resistivity) and then calculating resistivity values independently from the attenuation and phase shift measurements that are consistent with the correlative relationship... An implicit and instrumental assumption in this method is that the attenuation measurement senses both the resistivity and the dielectric constant within the same volume, and that the phase shift measurement senses both variables within the same volume (but not the same volume as the attenuation measurement). See for example U.S. Patents 4,899,112 and 4968,940. These assumptions facilitate the independent determination of a resistivity value from a phase measurement and another resistivity value from an attenuation measurement. However, the implicit assumption mentioned above is not true; so, the results determined using such algorithms are questionable."

The correlative relationship between the resistivity and the dielectric constant is described, with respect to FIGURE 8, element 816, in columns 12 and 13 of *Clark et al* as follows:

> Referring to FIG. 8, there is shown a flow diagram of a routine with which a processor can be programmed (typically before an operation) to obtain and store the look-up table for obtaining an apparent resistivity from the phase measurement, and for obtaining an apparent resistivity from the attenuation measurement... As described further hereinbelow, depending upon the frequency of operation and the conductivity of the formations being investigated, the dielectric permittivity may have a substantial effect upon the measurements, particularly at relatively high resistivity. However, ***an assumed dielectric permittivity can be obtained with reasonable accuracy as a function of conductivity***, and then utilized to obtain a more accurate measurement. This may

be done ***by using a look-up table which assigns a value of dielectric permittivity as a function of conductivity***, as represented by block 816 in FIG. 8."

14. As also described in the Background section of the instant invention, Applicant has found that use of the above described prior art methodology (as represented by *Clark et al*) may result in significantly incorrect resistivity values, even in virtually homogenous earth formations. The errors may be even more severe in heterogeneous formations. The instant invention endeavors to overcome these deficiencies in the prior art, in part, by abandoning the above described false assumptions. As such, the present invention enables calculation of at least one parameter of a subterranean formation (e.g., conductivity and dielectric constant) such that it has ***no net sensitivity*** to the other parameter. This characteristic of the invention is recited clearly in independent claims 30, 45, and 55. Claim 30 recites: "wherein said assigned value for the first electrical parameter is ***insensitive*** to the second electrical parameter." Claim 45 recites: "wherein said assigned value for the first electrical parameter is ***insensitive*** to said assigned value for the second electrical parameter." Claim 55 recites first and second results "being ***sensitive*** to the first electrical parameter and ***insensitive*** to the second electrical parameter".

15. Applicant respectfully submits that there is no such disclosure in *Clark et al*. In fact, as described above, *Clark et al* teaches the opposite, namely a dielectric constant that is a mathematical function of conductivity (and thus a conductivity that is a function of dielectric constant). Using the language of independent claims 30, 45, and 55, *Clark et al* teaches a first parameter that is ***sensitive*** to a second parameter. This is in direct contrast to claims 30 and 45 which recite an assigned value for a first parameter that ***insensitive*** to a second parameter and claim 55 which recites first and second results that are sensitive to the first parameter and insensitive to the second parameter. Accordingly, *Clark et al* cannot anticipate the instant invention as recited in claims 30, 45, and 55. Applicant therefore respectfully requests the Examiner to withdraw his §102 rejections of claims 30, 45, and 55.

16. Applicant respectfully submits that independent claim 66 is also patentably distinct over *Clark et al*. As described above, claim 66 recites a method in which first and

second transformations include a permuted dielectric assumption. Applicant respectfully submits that *Clark et al* is void of any disclosure or suggestion of a transformation including a permuted dielectric assumption. In particular, there is no disclosure or suggestion in *Clark et al* of evaluating a coupled system of equations including an attenuation conductivity σ_A and a dielectric constant correlated with a phase conductivity $\varepsilon(\sigma_p)$ and/or a phase conductivity σ_p and a dielectric constant correlated with an attenuation conductivity $\varepsilon(\sigma_A)$ (as shown and described in Paragraphs [0100] and [0103] of the original specification). On the contrary as described in relation to FIG. 8 (in columns 12 and 13), *Clark et al* discloses a method for determining an attenuation conductivity and/or a phase conductivity. In determining an attenuation conductivity, *Clark et al* utilizes ***a non-permuted dielectric assumption***, in particular a dielectric constant correlated with an attenuation conductivity (using the notation of the instant invention σ_A and $\varepsilon(\sigma_A)$). In determining a phase conductivity, *Clark et al* utilizes ***a non-permuted dielectric assumption***, in particular a dielectric constant correlated with a phase conductivity (σ_p and $\varepsilon(\sigma_p)$). This is in direct contrast to the ***permuted dielectric assumption*** recited in claim 66 and described hereinabove. Applicant therefore submits that *Clark et al* cannot anticipate independent claim 66 and requests the Examiner to withdraw his rejection of said claim.

17. For the foregoing reasons, Applicants respectfully submit that independent claims 30, 45, 55, and 66 are allowable. Applicants request reconsideration and allowance of claims 30, 45, 55, and 66. Since independent claims 30, 45, 55, and 66 are allowable, it follows *a fortiori* that dependent claims 31-44, 46-54, 56-65, and 67-76 must also be allowable, since these dependent claims carry with them all the elements of the independent claims to which they ultimately refer.

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Applicant believes that in view of the foregoing remarks, pending claims 30 through 76 are allowable, and that this application is now in full condition for allowance, which action Applicant earnestly solicits. Should the Examiner have any questions, or believe that a telephone interview may expedite the further examination of this application, the Examiner is requested to contact the undersigned at the telephone number shown below.

Respectfully submitted,

Date: 6/11/07

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